

Trachelizus bisulcatus, Lund, Mons. Power informs me, is common in the extreme East, and that specimens have been reported from China and Japan. In the Munich Catalogue the locality given is Java; and I hesitate at present to include it in the Japan list.

EXPLANATION OF PLATE XII.

- Fig. 1. *Zemioses celtis*, Lewis.
 2. *Cyphagogus signipes*, Lewis.
 3. Ditto, femur from above. 4. Leg, side view.
 5. *Jonthocerus nigripes*, Lewis, ♂. 6. Ditto, ♀.
 7. *Zemioses celtis*, femur from above. 8. Leg, side view.
 9. *Higonius cilo*, Lewis. 10. Side view of head.
 11. *Baryrrhynchus Poweri*, Roelofs, ♂.
 12. *Orychodes insignis*, Lewis, ♂.

On the Structure of the Hard Parts of the Fungidæ.—Part II.
 Lophoserinæ. By Prof. P. MARTIN DUNCAN, F.R.S., F.L.S., &c.

[Read June 21, 1883.]

(PLATE XIII.)

CONTENTS.—I. Introduction: the Subfamily Lophoserinæ.—II. Genus *Lophoseris*, its Diagnosis and Details of Species.—III. Genus *Mæandroseris* and its necessary Division: Generic Diagnosis of *Plesioseris*.—IV. The Structure of the Genus *Pachyseris*.—V. The Structure of *Coscinaræa meandrina* and its Zoological Position.—VI. Remarks on the Anatomy of *Siderastræa*, *Merulina*, and *Echinopora*.—VII. Remarks and Considerations regarding Classification.

I. *Introduction*.—The former communication on the structure of the sclerenchyma of the Fungidæ related to the subfamily Funginæ; the present concerns the structural details of some of the compound corals belonging to several of the recent genera of the subfamily Lophoserinæ.

An examination of the recent Lophoserinæ is absolutely requisite before the classificatory position of many extinct genera of corals can be decided. Hence the examples chosen to illustrate this communication have a palæontological bearing; but I do not enter into the subject of the construction of the forms included in such genera as *Comoseris*, *Oroseris*, *Thamnastræa*, &c., because it belongs more to the province of the Geological Society; and this essay is introductory to such a one.

Very soon after this communication was commenced, I became aware that the internal structures of the compound Lophoserinæ

were very varied, and that in order to illustrate the connexion of the subfamily with the Astræidæ, on the one hand, and with the Perforata, on the other, it was requisite to extend the researches and to investigate such genera as *Siderastræa*, *Echinopora*, *Merulina*, and *Coscinaræa*.

The definition of the subfamily by its authors is, "The wall is never perforated nor echinulate in the Lophoserinæ." By the wall the common basal plateau is meant; and it has been explained in the former communication (page 137) that in the other subfamily, the Funginæ, the basal wall is perforated and echinulate. The diagnosis of the Fungidæ, the family thus subdivided, is that the interseptal loculi are crossed by synapticula, which are special growths and not simple granulations. A negative character is the absence of endothecal dissepiments. Moreover the septa may be solid or more or less trabecular and perforate.

The genus *Lophoseris* is taken as a typical example, then the genus *Mæandroseris*, with collines limiting series of calices, is considered. *Pachyseris* follows as a most abnormal form, the collines being in excess; and the genus *Coscinaræa* is examined. Finally, the genera *Siderastræa*, *Echinopora*, and *Merulina* are examined. All this involves some classificatory changes and the introduction of a new genus; but the importance of the synapticula as a character of the group is enhanced.

II. Genus *Lophoseris*, its Diagnosis and Details of Species.

The genus *Lophoseris* of Milne-Edwards and Jules Haime replaces *Pavonia* of Lamarck; and it has somewhat unfortunately given the name to the subfamily.

"The corallum is compound, adherent, foliaceous, and usually grows upwards in irregular lobes or crests, which are covered with radiating confluent calices. Collines are present, and also keel-shaped prominences covered with septo-costæ; they are placed from below upwards along the line of upward growth of the corallum. The columella is tubercular and sometimes rudimentary. The base is finely striated"*.

Nothing is said in this diagnosis of the nature of the synapticula, of the nature of the separation between the calices, or of the existence of calices in some species on both sides of the frondiform corallum.

Lophoseris contains species which have and have not vertical

* 'Hist. Nat. des Corall.' vol. iii. p. 65, slightly altered.

collines; and in some there are none at all: the length of the septo-costæ differs greatly.

Lophoseris cristata, Ellis and Solander, sp., and *L. explanulata* Lamk., sp., may be taken as types of the crested and plain species. In the first species the calices are on both sides of the laminated corallum. The septa are not perforate, but are well developed and sharply granular at the top and sides.

The central fossa is deep, and the columella is essential, as it springs from the base of the calice and is not formed by the septal ends; it is composed of two or three rods united here and there by transverse synapticula. The septa of one calice are continued over the rounded, united margins to the neighbouring calices, and the interseptal loculi, rather deep near the fossa, become shallower externally. There is a small septo-costa between the larger ones, and it rests on the floor of the interseptal loculus which passes from the contiguous calices; this is bounded below by the tops of synapticula which are sometimes distinctly separate, and at other times formed into a solid wall. In rapidly growing calices the synapticula can be seen from above; they are large, and do not relate in any way to granulations which exist above them. There are spaces between the synapticula, when seen from above, as in *Fungia*. A section or fracture, parallel to the septo-costæ, shows rather tall synapticula, some being vertical and straight, and either narrow or broad, and others curved, short, and mostly low down. Occasionally a growth unites the synapticula, which may be parallel or not. With age, however, a distinct wall is produced between the calices and in the collines; and it is partly formed by an original vertical wall resembling a narrow synapticulum, and by the fusion of the synapticular growths on either side of it into one mass. So that in solid parts of the corallum the synapticula are not seen in series of three or four on the floor of the shallow loculi, but there is one convex mass. But as growth proceeds, traces of new synapticula are seen above the mass of the wall. The stout synapticula of the interseptal loculi are very different in appearance to the transverse synapticula between the columellary rods, which are comparatively thin; but in some parts of the calices there are thin synapticula. These are not dissepiments. Near the edge of the corallum, where growth is most rapid and the costæ are long, often slightly sinuous, and highly granular, the loculi are shallow, and there are no synapticula there;

but near the newest calices these cross structures commence as junction-structures superadded to the septa and independent of the base. Some very delicate synaptacula may be seen there.

In *Lophoseris explanulata* the specimen examined gave no indications of synaptacula when seen from above; only a solid wall was to be seen between the calices surrounded by the septo-costæ. Synaptacula exist on either side of, and close to, the wall on the septa; and they are close and plainly visible at the very extremity of the septal interloculi. In this species, as in the other, these growths are many times thicker than granules, and have nothing in common with them.

The vertical direction of the synaptacula and their considerable dimensions cause them to close much of the interseptal loculi. The growth into a structure which acts as a wall and shuts off the visceral cavities of the neighbouring corallites is very interesting.

III. *Genus Mæandroseris and its necessary Division.*

GENUS MÆANDROSERIS, *L. Rousseau* *.

A zoophytologist who only studies the recent coral-fauna would examine the species included in this genus without much interest; for it is one which at first sight falls readily into association with other Lophoserine compound corals. It comprises Lophoserines with confluent calices with distinct centres, but which are in series, the series being separated by long or short collines, over which pass the septo-costæ. A palæontologist will study the forms with great interest; for they recall the Mæandriform Lophoserines of the Jurassic age. Externally the similarity is complete; and, indeed, MM. Milne-Edwards and Jules Haime decide that the only distinction is the presence of an epitheca in *Comoseris*. An examination of the minute structures of the species is requisite before any change in the classification can be decided upon; and it adds to our knowledge of the Lophoserinæ in a marked manner, showing how closely allied forms indicate aporose and perforate affinities.

There are two species of *Mæandroseris* recorded—one the type of the genus, *M. Bottæ* of the Red Sea; the other, *M. australiæ* of the Australian seas.

The generic diagnosis of *Mæandroseris* is as follows:—

* D'Urville, 'Voyage au Pôle Sud, Zool.' t. v. p. 121.

The corallum is compound, adherent, thick, and mæandroid. The base is naked, sublobed, and finely costulate. The calices are grouped in simple linear series, and each series is separated from its neighbours by simple and low collines. The calicinal centres are distinct, and there is a papillary columella. The septa are numerous, radiate, and are very granular and "*crépus*."

The diagnosis of *M. Bottæ* and a figure are given by Rousseau*; and the diagnosis is repeated by MM. Milne-Edwards and Jules Haime†. It refers to one specimen, and relates also to shape, which depends upon peculiar growth.

A specimen from Mergui collected by Dr. Anderson, F.R.S., indicates that the following is a correct specific diagnosis:—

The corallum is flat or slightly concave above, not universally adherent, tall or short. The base has its costal markings long and alternately large and small, finely dentated, and somewhat flexuous.

The collines bound long and short series of calices, and, on the whole, radiate from the centre to the circumference; they are broad, but high, and often show no trace of development in a special direction. The calices are shallow, the columellary space is small and deep, the columella is papillary, and the septa, often formed by the union of several, are close, confluent, subequal, stout, and granular at the sides, and warty and crisped above. There are from 30 to 40 septa. The calices are from 4 to 8 mm. in breadth, and the increase is by budding between contiguous calices.

The Construction of the Hard Parts of Mæandroseris Bottæ.—The interseptal loculi extend from calice to calice and over the collines; they are very narrow, and hence their depths cannot be penetrated by vision from above. They are widest and deepest near the calicular centres, and are narrow and shallow elsewhere.

The compound granulations on the free edge of the septo-costæ are warty, broad, tall, and separate, and each one is the summit of one of the trabeculæ of which the septum is composed. These granulations extend laterally, but do not touch over the interseptal space, neither do they touch their neighbours on the same septum. They arise from more or less constricted necks.

* *Op. cit.* pl. 28. fig. 1.

† 'Hist. Nat. des Corall.' vol. iii. p. 61.

Below the granulations, and on the sides of the septa for a short distance down the interloculus, are some distinct small conical granules; and still lower down are the highest synapticula, which nearly close in the loculus.

A section or a fracture of the coral breaks the synapticula across, and reveals the structures of the septa. These are trabeculate, especially near their free edges, are moderately stout, and consist of vertical or slightly inclined processes swollen out at regular intervals, and uniting at their sides within and without, in the proper position of the coral in relation to the calicular centre, with those next to them, by the same kind of structure. As there is some symmetry in the succession of swellings and constrictions of the series of trabeculæ, there are more or less regular, oval or circular foramina in vertical rows in the sides of the trabeculate septa. This fenestration diminishes low down, and is often replaced by parts of synapticula.

Each warty granulation on the free side of a septum is analogous to the swelling of a trabecule; and were its sides (distal and proximal to the calicular centre) to unite, the union would represent the process which unites the trabeculæ lower down, and the involved and included spaces would mimic the fenestration. During the growth of the coral this union takes place; and each of the successive nodules of a trabecula was once a warty granulation at the free surface of the septum.

The sides of the nodules and intervening thinner parts are ornamented here and there, and especially near to the calicular centre, with distinct granules. Amongst these, and covering more space, are small synapticula, circular more or less in fractured outline, sometimes elongate, but low (in vertical measurement), extending over more than one nodule and internodular process, and also lumpy irregular synapticula covering much of the septal surface low down, occluding fenestrations, and occupying much of the loculus.

The synapticula, varying greatly in their shape, occur between the septo-costæ of the collines, and usually the long kind predominate elsewhere, except low down, where the shape is very irregular. The absence of synapticula on the septal surfaces close to the calicular fossa is evident. *There are no walls to the calices or collines.*

Sections across the line of the septa and septo-costæ show the irregular dimensions of the synapticula and the spaces they close

more or less, together with the granulations upon the nodular trabeculæ. The number of synapticula on the sides of a septum is considerable in some instances, and of course it varies with the position of the septum in the corallum.

Here and there are thin lamellar processes crossing a small part of an interseptal locus resembling ill-defined dissepiments. In some instances they are in the line of elongate synapticulæ; but invariably a perforating annelid is close at hand. They are transverse growths. Near the calicular centre and on the flanks of the septa the granules, none of which meet across, are long, large, and in linear series. Here and there the series is replaced by a ridge which fits on to a similar one on the opposed septum, and it is a synapticulum.

The base of the corallum is imperforate, and the columellary space is open above; but it soon becomes interfered with by the nodular processes of the innermost trabeculæ of septa. The trabeculæ of the septa are arranged as if a septal lamina had been perforated after its development; they radiate on one plane, and occlusion of the foramina occurs during growth.

The collines of this species have not a true wall, nor are the calices surrounded by one. The separation is incomplete, and is brought about by a series of vertical synapticula, or by one more or less incomplete synapticulum. The first stage to a true wall is seen, as in the young of other Lophoserines (of *Lophoseris*, for instance); but fusion of the junction-processes with one another does not take place in *Mæandroseris Bottæ*.

No one can take this species for one of the Perforata, the distinction being the solidity of the base and the presence of solid large synapticula which close here and there the visceral cavity, and which are not exaggerated granules. It links the Fungidæ on to the Perforata very decidedly, and less so, however, than the genus *Coscinaræa*, which will be considered further on.

Mæandroseris australiæ, Rousseau, is the second species; but an examination of a specimen given to me some years since by the late Charles Darwin, and collected by him at Keeling atoll, still indicates that its septal and mural structures differ greatly from those of the species just considered. In fact the generic attributes of *M. Bottæ* are very evidently those given by Rousseau; but the species named *M. australiæ* cannot belong to the same genus as *M. Bottæ*, in spite of external appearance. It has a true

wall running along the long axis of the collines, whatever may be their length ; and the calices, even when in close series, are limited by a mural growth. The septa are not trabecular ; and it is only near the columella, which is partly formed by ascending processes of their curved edges, that there is any sign of porosity. The septa join to form those of the principal orders in some parts of calices ; and the synapticula are of two kinds—large, tall, and vertical near the wall ; and small, short, and irregularly placed nearer the inner edge of the septa. The specific diagnosis* does not consider the internal structure in any way. “ The corallum is in a convex mass, globose, and even irregularly nodular, and crested on the surface. The series of calices are short and slightly confused ; and they are separated by low collines. The calicular centres are distinct. The columellary is papillary and tolerably well developed. The septa are thin, close, very crisped, and there are about 20 to a calice ; they are of different sizes, and the small often unite with the larger. The breadth of a calice is 3 millim.” The crisped warty spinulose granules of the free surface are very marked features. The granules on the flanks of the septa are well marked, and never coalesce.

The form comes under the genus *Plesioseris*, gen. nov., amongst the Lophoserinæ.

Corallum massive, compound, adherent, without epitheca. Surface irregular and nodular. Calices in short series confluent by their septo-costæ ; centres distinct. Columella-wall developed and papillary. Septa uniting ; laminae solid except near the axial space, where ascending oblique processes are trabeculate. Granulation warty and spinulose on the free edge, distinct and separate on the laminae. Series of calices separated by short collines ; valleys moderately deep and narrow. Walls in collines and around calices. Synapticula of two kinds—one, long, broad, vertical, in two rows near the wall ; another, small, nodular, near the axial space. Growth by gemmation beyond and between the calices.

The solid nature of the septa and the mural structures separate the genus from *Mæandroseris*.

IV. *The Structure of the Genus Pachyseris.*

Probably there is no genus of Zoantharia Sclerodermata which so little maintains the ordinary idea of a stony coral as

* ‘Hist. Nat. des Corall.’ vol. iii. p. 62.

Pachyseris. There are no separate calices to be seen; and it appears to consist of long concentric ridges separated by low valleys, the elevations being produced by vast numbers of septa placed side by side. Its species resemble corals less than those of *Mæandrina*, and yet they may be said to be mimetic types.

Pachyseris is the fullest development of the serial calicular arrangement; there are no individuals in a series, and it is all one long calice with its septa passing in one direction, over the colline, to those of the next calice in order from within outwards, and in the other sinking down along a line where there is a columellary space and perchance a columella.

The following is its diagnosis according to MM. Milne-Edwards and Jules Haime ('Hist. Nat. des Corall.' vol. iii. p. 85):—The corallum is compound, adherent, foliaceous, and very variable in shape. The collines are arranged in simple series, those of each series being completely confounded with each other. The series are separated by unequal-sized collines. The septa are delicate and close. The columella is tubercular, moniliform, and generally tolerably distinct. The basal wall is naked and finely striated.

In explanation, the authors notice that the genus contains those Fungidæ the calices of which completely unite in series, losing all individuality as in *Mæandrina*.

MM. d'Archiac and Haime described a species from the Nummulitic of Sind; and it is stated to have been found also at St. Bonnet in the French Eocene.

This form I found was a characteristic species of the Lower Eocene of Sind beneath the great development of Nummulitic limestone*.

Two well-developed species with the details on a grand scale were described from the Miocene (*Gáj*) of Sind. In one, *Pachyseris exarata*, nobis, the septa are unequal, and there is a columella; whilst in the other, *P. affinis*, the columella is rudimentary †.

Four recent species are known, and in *P. rugosa*, Lamk., sp., the septa are alternately slightly unequal and slightly enlarged near the columella; in *P. speciosa*, Dana, sp., there is more irregularity of septa and a well-developed columella; in *P. lævicollis*, Dana, sp., the inequality is evident and the columella is rudimentary; and, finally, in *P. Valenciennesi*, Edw. & Haime, the septa

* 'Fossil Corals and Alcyonaria of Sind,' Pal. Ind. ser. xiv. 1880, pl. xiv.

† *Ibid.* p. 96.

are equal, the columella but little developed, and the series are short and the valleys deep.

A species from Mergui, which resembles *P. speciosa*, so far as Dana's illustration is concerned *, and were it not for the equality of its septa would come fairly under that name, has been examined.

The structural details of the coral are remarkable; and I have never had an opportunity of examining a specimen of Dana's type. Hence I call the form under consideration *Pachyseris speciosa* provisionally, my object being to bring forward the internal structure rather than to deal with specific attributes and comparisons in this instance.

The form is in thin leaf-like shapes fixed where narrowest, and expanding on one plane, or becoming twisted up and curved. The inferior or basal surface is marked with slender costæ alternately large and small, the larger projecting slightly; they correspond with septa at the edge of the corallum which are equal in breadth. The surface is minutely granulo-spinate.

The series are very long, irregularly concentric, and bifurcating here and there. The collines are moderately deep and slightly inclined. The septa are very numerous, close, equal, thin, finely dentate where free, sometimes wavy and bent, and very granular on their sides. The columella, seen from above, fills the axial space, and unites the opposite septa in a continuous gutter.

An examination of the structures shows that whilst the lateral granulations of the septa are profuse, and occupy much of the interseptal loculi, the synapticulæ are usually not seen from above. These are sufficiently distant from the free edges of the septa not to be visible; but near the edge of the corallum, where growth has gone on lately, the bodies can be seen, and are clearly not united or fused ornamental granules.

A section through the corallum shows the thin and very solid basal lamina from which spring the septa. These are slender close to the base, equal and with well-defined interseptal loculi. The lowest synapticula are nearly everywhere at the same level at a little distance above the basal lamina. Above the first row of synapticula the septa are broader, and, in section, their outline is very irregular on account of a succession of small ornamental granules and large synapticula and of synapticula not sufficiently developed

* Dana, 'Zoophytes, Explor. Exped.' pl. 21. fig. 7.

to meet. The synaptacula are in close and regular succession in some places, are nearly as high as the septa are broad, are of course narrow on account of the proximity of the septa, and are never continuous, as in *Fungia*. Usually the synaptacula are slightly dice-box shaped; and there may be from eight to twelve in a vertical series in the interseptal loculus on each side of the axis of the colline.

The collines form more or less convex projections; and as they consist of septa placed side by side and very close, it is evident that the synaptacula nearly fill up the interseptal loculi. Is there a wall separating one side of the colline from the other, and reaching along its long axis from the basal lamina to near the free surface?

There is no true wall, but a long synapticulum more or less discontinuous is in the vertical line, and it is tolerably broad. The synaptacula already noticed are on either side of it near the junction of the septal margins (vertical) with the columella.

The columellary structure was clearly indicated by Dana in a small drawing* of the structures of *Agaricia rugosa*, which is probably *Pachyseris Valenciennesi*. In the specimen now under consideration the columella is a mere groove above; but a section across the line of the collines and valleys shows that the columellary space is crossed by numerous tabulate-looking processes which stretch from the free edge of one septum to another. In number these processes tally almost invariably with the synaptacula in vertical series; and as these last are generally on the same level in the interseptal loculi, it happens that the columellary synaptacula start from the long inner surface of the level synaptacula and corresponding free edges of the septa. So that long tabulæ are produced one over the other, and closing in the narrow axial space. The uppermost forms the visible columella.

The granulations on the sides of the septa are exceedingly developed in young or outer series; but it is perfectly evident that they form no part of the synapticular structures. The septa are rarely perforate.

The basal lamina is very solid, and its growth appears to be truly thecal, and not synapticular.

There are no endotheal dissepiments in *Pachyseris*; and the interseptal loculi, instead of being open down to the basal wall, are partly occluded by vertical series of synaptacula; and the

* Dana, *op. cit.* pl. 22: fig. 1 b.

axial space is very shallow, and it is limited by the cross-bar structure of the so-called columella. The solidity of the septa is very general, and trabeculæ appear during growth and become fused eventually. It will be interesting when the soft parts of one of these species is examined, for considering how the hard parts differ from the Mæandroid Astræidæ, which have cellular endotheca in the collines and more or less perfectly solid vertical walls*. A suspicion arises that this Fungid may not belong to the same great group in the animal kingdom.

The next genus to be considered brings the Lophoserinæ in close relation with the Perforata.

V. *The Structure of Coscinaræa meandrina and its Zoological Position.*

The genus *Coscinaræa*, Milne-Edwards and Haime (Compt. Rend. t. xxvii. p. 496, 1848, and Hist. Nat. des Corall. vol. iii. p. 203), has been placed by the distinguished describers amongst the perforate Madreporaria in the family Poritidæ. One species is known, and it was called *Madrepora monile* by Forskål, *Meandrina* by Savigny, and *Astræa meandrina* by Ehrenberg. It clearly could not belong to either of these genera. MM. Milne-Edwards and Jules Haime named the species *Coscinaræa meandrina* (*op. cit.* p. 204); and there is a figure in Ann. des Sci. Nat. sér. 3, t. ix. pl. 5. fig. 2 (1848).

The Poritidæ of MM. Milne-Edwards and Jules Haime may be described as a family of Perforate Corals as follows:—"The corallum is compound and entirely composed of reticulate sclerenchyma which is trabecular and porous: the individuals are always intimately united either by their walls or by an intermediate reticulate cœnenchyma. The increase is by gemmation, ordinarily extracalicular and submarginal in position. The septal apparatus is distinct, but never completely lamellar, and is formed by a series of trabeculæ which form a trellis-work by their union. The walls present the same kind of base and porose structure. The visceral chambers sometimes contain rudimentary dissepiments and never tabulæ."

This important family is readily divisible into two subfamilies. In one, the Poritinæ, there is no cœnenchyma between the indivi-

* Some have a profusion of transverse endothecal dissepiments, and the wall is reduced to a narrow growth near the base.

duals ; and in the other, the Montiporinæ, there is much intermediate areolar tissue.

MM. Milne-Edwards placed the genus *Coscinaræa* in the first-named subfamily, and gave the following diagnosis of it :—"The corallum is massive and composed of a hard tissue ; its common base is composed of a striated lamina which appears to be imperforate and to be without epitheca. The calices are rather deep, often form little series, and increase by calicular and submarginal gemmation. There are no pali, nor are there distinct walls between individuals. The septa are numerous, close, regularly fenestrated with crumpled edges, and they merge into those of the neighbouring calices."

Coscinaræa meandrina is a recent form, and lives in the Red Sea and the Indian Ocean ; and I have lately received it from Mergui. It is found subfossil on raised beaches along the Red Sea.

Klunziger, in his admirable work 'Die Korallthiere des Rothen Meeres,' vol. iii. p. 78, redescribes this species and places it amongst the synapticolate corals (1879). He restores Forskål's specific name.

Every body who handles a specimen of this coral must be struck with its resemblance to the Oolitic genus *Microsolena*, and also partly to *Mæandraræa*. Superficially there is no distinction between it and *Microsolena* ; but a careful examination of its internal construction indicates that the affinity is remote, and that the genus *Coscinaræa* is not one of the Poritidæ. In fact its zoological position is amongst the synapticolate corals of the Lophoserine subfamily of the Fungidæ.

Description of a Specimen of Coscinaræa meandrina, Ehr., from Mergui.

The corallum is low, convex above, encrusts, and has a thin free margin.

The base, where not encrusting, is a thin solid imperforate wall or theca marked with distinct costæ, which are large and alternately large and small where remote from the margin of the corallum, and almost subequal and small at the margin, where they are continuous with the long septa of the circumferential calices. Towards the centre of the base the largest and broadest costæ become narrow projecting ridges ; and here and there near the encrusting area the minuter costæ are sharply spinulose.

There is no epitheca.

The upper surface of the corallum is marked with irregularly shaped calices, short series, and slightly projecting intermediate ridges. A row of small calices is close to the margin, and the larger ones are nearer the centre. The calices are usually deep, and have a deep fossa around the small, slightly papillose columella; the septa are close, subequal, and whilst some are simple, others are composed by the union of many others. The septa of one calice pass over the low flat collines, and unite with those of other calices, or reach the margin. They are ornamented on their free edge with subequal flat spines, broad and blunt above, placed at regular and close distances; their tops are minutely spinulose. Near the wall on which the septa rest and whence they spring their laminae are solid; higher up they are perforated in a moderate degree, and especially near the columella. On the flanks of the septa are tolerably regularly placed nodules which unite with the adjoining laminae and are synapticula in the Lophoserine sense; that is to say, they are discontinuous, yet more or less in vertical series. They are placed on the solid and grow on the trabecular part of the septa, are in relation to vertical nodular swellings on the septa and trabeculae, and are as stout as the septa in some places.

The growth of the corallum occurs by gemmation from the long septo-costæ at the margin, by gemmation (intracalicular) from within the well-formed calices, and also by fissiparity.

The short series have usually the calicular centres distinct, but not always; and the colline bounding the series towards the margin, or separating one series from another, is higher than the almost rudimentary eminences between the serial calices.

The longest calices are 1 centim. long and 4 millim. deep.

The nature of the basal wall, the solid structure of the septal laminae in contact with it, the junction of the higher orders of septa with others to form large septa reaching the columella, the synapticula, and the absence of endothecal dissepiments place this form amongst the Lophoserinæ. The specimen I have examined does not show any endothecal dissepiments. But as in other Lophoserines the intrusion of parasites has developed extremely delicate endotheca near the morbid spot, but not elsewhere, this, I believe, is explanatory of the figure of them given by Milne-Edwards and Jules Haime.

VI. *Remarks on the Anatomy of Siderastræa, Merulina, and Echinopora.*

Genus *SIDERASTRÆA*, *Blainville*.—Syn. *Astræa*, *Oken*.

This genus, partly established by Lamarck and Blainville, is the *Siderina* of Dana, and was termed, after a careful study, *Siderastræa* by Milne-Edwards and Jules Haime. In their great work these last-named zoophytologists altered the name to *Astræa*, given by Oken in 1815.

In the diagnosis of the genus Milne-Edwards and Jules Haime state, with regard to the septa, "The sides are covered with very large granules which often meet (across the interseptal loculi) those of the opposed septa, and unite so as to form incomplete synapticala. The endotheca is rudimentary."

Pourtalés has drawn, in his 'Florida Corals,' a beautiful section of a *Siderastræa*, and shows that the calices have walls, and that there are rows of synapticala besides granules, and some endothecal dissepimental tissue.

In the species I have examined from the American and Indian seas the drawing of Pourtalés is substantiated. The synapticala are not enlarged granules, and are in regular vertical series with but little space between them when they are placed one above the other on the septa. There are granules in abundance around them and nearer the internal edge of the septa also.

Endothecal dissepiments also exist crossing the line of the synapticala; and they are normal structures, not being developed in consequence of annelid growths, as in *Mæandroseris* and other forms. The true wall separates the calices, and the interseptal loculi are intruded upon by the rows of synapticala near the wall and by the dissepiments.

Dana evidently considered this genus to belong to the Fungidæ; for he terms one species *Pavonia* (= *Lophoseris*) *Siderea*.

It is evident that the presence of endothecal dissepiments is a marked feature in this genus; moreover, the living part, when expanded, resembles that of the Astræidæ. It cannot therefore enter the Fungidæ proper, where my late friend Pourtalés proposed to place it.

Genus *MERULINA*, *Milne-Edwards & Jules Haime*.

This genus is placed in a transition group between the Astræidæ and the Fungidæ.

The corallum is compound and more or less foliaceous, and the basal wall is perforated like that of the Funginæ. There are no synapticula, and there are endothecal dissepiments.

An examination of specimens of two species proves that this perforation of the wall is not invariable, that it does not occur in some collines at all, and that in others, where it does occur, it has not the same significance as the perforations of the wall described in the first part of this communication (see Journ. Linn. Soc. vol. xvii. pl. v. figs. 1, 2, 3, and pl. vi. figs. 3 & 6).

In some old specimens the foliaceous expansion is only seen at the margins of the corallum, and elsewhere there are calices and collines on both sides of the colony. There is no perforation in such instances; and the small foramina seen between the septo-costæ open into a dissepimental cell-space far above the wall.

Moreover, the importance of all synapticula in relation to the interloculi and their invariable presence in Fungidæ takes the *Merulina* quite beyond that family. I relegate it to the Astraidæ, especially as the transitional nature of *Siderastræa* is so evident.

The genus *Echinopora* of Lamarck and Dana was very naturally called *Agaricia* by Schweigger, for it has a very Fungid appearance. Verrill has placed the genus amongst the Fungidæ; and an examination of some specimens proves that he is correct; but I fail invariably to find synapticula, and, indeed, where I have detected them, they are very ill-developed and near the bottom of the interseptal loculi, and amongst much dissepimental endotheca. In some places the upper free edges of the septa fuse in a synapticular fashion.

VII. *Remarks and Considerations regarding Classification.*

It is evident that in the genera *Lophoseris*, *Mæandroseris*, *Plesioseris*, *Pachyseris*, and *Coscinaræa* the synapticula are important structures, not exaggerated granules, and that they may be the only means by which the septa are united and the cohesion of the corallum maintained above the solid basal wall. It is evident that they may fuse and form a false wall which may limit calices and unite the septa along collines. I do not distinguish in the recent species of the subfamily Lophoserinæ any structures which may be called false synapticula.

The synapticula occupy much of the interseptal loculi, and tend to produce canal-shaped spaces therein, more or less vertical

and transverse in direction. Usually the synapticula remain separate; but in some instances they unite laterally, above and below, and form a dense structure which acts as a calicular wall. They do not form long and more or less vertical ridges on the sides of opposed septa as in Funginæ, but one synapticulum may be long and nearly sufficiently continuous to act as a wall.

The septa in the Lophoserinæ may be solid or trabecular in some parts; some bring the subfamily in relation to the Perforata; but the classificatory distinction is evident.

The calices may be surrounded by a wall, or its place may be occupied by distinct synapticula or by those which have become fused with age and growth.

A true dissepimental endotheca is not present in the Lophoserinæ. Minute growths of it are produced by disease. Hence this absence observed by Milne-Edwards and Jules Haime is significant and of classificatory value.

The family Fungidæ is really something more than a transitional group between the Astræidæ and Perforata: it has a great individuality. Although certain forms, such as *Mæandroseris* and *Coscinaræa*, ally it to the last-named group, they need not be placed beyond the Lophoserine subfamily; and they belong to it.

The new genus *Plesioseris* has a true wall, and its septa are like those of many Astræidæ amongst the Aporosa; its synapticula are well developed, and its external resemblance to *Comoseris* of the Jurassic rocks is great. There are no endotheal dissepiments. So that this genus and *Lophoseris* stand as most typical Lophoserines, and nearer the Astræidæ than *Mæandroseris* and *Coscinaræa*.

Milne-Edwards and Jules Haime wrote about the incomplete synapticula of *Siderastræa*. In 1863, in describing *Siderastræa grandis* of Jamaica (Quart. Journ. Geol. Soc. May 1863, p. 441, pl. xvi. figs. 5a and 5b), I noticed the synapticula; and, later on, Pourtalés gave a beautiful plate proving their true nature beyond a doubt. The genus has endotheal dissepiments; and, as in the case of *Echinopora*, this structural character removes it from the Fungidæ proper.

As *Merulina* turns out to be a serial Astræid, there is room for a group between the Aporosa, Astræidæ, and the Fungidæ; *Siderastræa* and *Echinopora* there find a resting-place.

DESCRIPTION OF PLATE XIII.

- Fig. 1. The septa, base, and synapticala of *Pachyseris speciosa*. Magnified.
 2. Diagram of section across colline: *a*, synaptical wall; *b*, synapticala; *c*, spaces between tabulate processes of columella.
 3. *Mæandroseris Bottaë*. Septa and synapticala. Magnified.
 4. The free top of a septum, showing warty ornaments. Magnified.
 5. Trabeculæ, side view, granules and synapticala. Magnified.
 6. Different sections of synapticala. Magnified.
 7. Outline of septo-costa of *Mæandroseris*, natural size.
 8. Oblique view, showing synapticala fractured on the side of the septum.
 9. Diagram of a young septo-costa with mural tissue on it and synapticala on either side.
 10. Synapticala between processes of the columella.
 11. Synapticala fused to form a short wall.
 12. Synapticala, from above. Magnified.

MOLLUSCA OF H.M.S. 'CHALLENGER' EXPEDITION.—Part XIX.
 By the Rev. ROBERT BOOG WATSON, B.A., F.R.S.E., F.L.S.

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[Read May 3, 1883.]

Fam. BULLIDÆ, *Stol.*

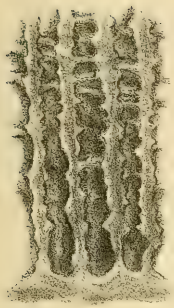
CYLICHNA.

- | | |
|------------------------------------|---|
| 1. <i>Cylichna discus</i> , n. sp. | 6. <i>Cylichna subreticulata</i> , n. sp. |
| 2. — <i>tahitensis</i> , n. sp. | 7. — <i>labiata</i> , n. sp. |
| 3. — <i>crispula</i> , n. sp. | 8. — (<i>Volvula</i>) <i>paupercula</i> , |
| 4. — <i>noronyensis</i> , n. sp. | n. sp. |
| 5. — <i>reticulata</i> , n. sp. | 9. — (—) <i>sulcata</i> , n. sp. |

1. CYLICHNA DISCUS, n. sp.

St. 24. Mar. 25, 1873. Lat. 18° 38' 30" N., long. 65° 5' 30" W.
 Culebra, St. Thomas, Danish W. Indies. 390 fms. Coral-mud.

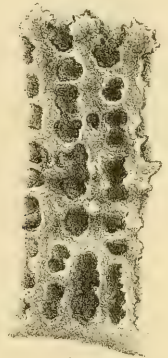
Shell.—Narrowly cylindrical, truncated in front like *C. alba*; brown, with a small disk-like minutely perforated top, smooth, thin, polished. *Sculpture*. Longitudinals—there are very faint and slight lines of growth. Spirals—there are some very doubtful indications of a coarse spiral structure in the texture of the shell. *Colour* milky white and glossy. *Mouth* the full length of the shell but not more, extremely narrow, with lips nearly parallel till they diverge in front, the inner lip following the slow basal



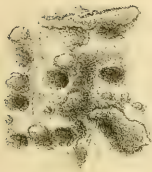
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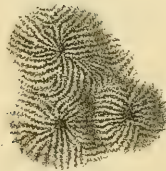
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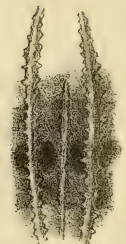
9.



10.



11.



12.

Duncan dir. Foorde lith.

LOPHOSERINE STRUCTURES.

Mintern Bros. imp.